

THE LEARNED SOCIETIES' GROUP ON SCOTTISH SCIENCE EDUCATION

NOVEMBER 2014

THE RESOURCING OF SCIENCE IN SCOTTISH SCHOOLS

Summary

In 2014 a survey was commissioned by the Learned Societies' Group into the resourcing of science in a sample of schools in Scotland. There were responses from 39 individual primary schools and 46 individual secondary schools. Results¹ indicate that science resourcing levels are not sufficient to fully and effectively meet the requirements of the curriculum. The main areas of concern picked up from the survey were:

1 *Equipment and consumable provision is not sufficient*

Primary schools

- 58% feel they do not have sufficient equipment and consumables.
- Less than half feel they have enough of specific listed equipment in working order.

Secondary schools

- 57% feel they do not have sufficient equipment and consumables.
- 82% are not confident in sufficient resourcing for practical work over the next two years.
- Schools have problems providing sufficient equipment to support the new Curriculum for Excellence courses that require more up-to-date equipment (e.g. only 22% reported having sufficient data loggers).

2 *Funding allocated to science resourcing in budgets is not sufficient*

The reported average annual spend per pupil on science in primary (£1.62) and secondary (£7.33) schools is lower than funding levels reported in comparative research conducted in England.

Primary schools

- 44% are dissatisfied with funding for science practical work.
- 98% draw on additional funding sources for practical activities with parental sources being most common for extra-curricular activities.

Secondary schools

- 80% are dissatisfied with funding for science practical work.
- 38% of total science spend is on reprographics, with only 17% on equipment.
- 98% draw on additional funding sources for practical activities, with teachers themselves being the most frequent contributors of the additional funds required for normal curricular activities.

3 *Teacher confidence is low in primary schools and teacher support is low at all levels*

Primary schools

- 52% are not satisfied with the access to training on equipment and consumables.
- 45% reported no access to safety equipment or an appropriate resources area.

Secondary schools

- 44% are not satisfied with the levels of technician support.
- 46% are not satisfied with preparation time in laboratories to carry out practical work.

The survey evidence provides the Learned Societies' Group with a starting point to engage with local and national government, their agencies and partners, head teachers, parents and industry to raise awareness about science resourcing issues in schools with a view to working towards the provision of better overall arrangements. Given the national policy drivers for enhancing and making the most of Scotland's science base, it will be important to ensure that analogous priority is given to STEM education at school.

¹ Resourcing School Science in Scotland: An Indicative Study of Primary and Secondary Schools; Pye Tait Consulting; November 2014
www.royalsoced.org.uk/1076_LearnedSocietiesGrouponScottishScienceEducation.html

Background

- 1 The Learned Societies' Group on Scottish Science Education (LSG) was established in 2012. Its remit includes identifying and promoting priorities for school science education in Scotland; monitoring and responding to school science education initiatives and developments; and stimulating debate relating to these issues in Scotland. The group comprises representatives from the: Association for Science Education, British Computer Society, Engineering Policy Group in Scotland, Institute of Physics, Royal Society of Chemistry, Royal Society of Edinburgh and Society of Biology.
- 2 In its 2012 report, *Supporting Scotland's STEM Education and Culture*², the Science and Engineering Education Advisory Group (SEEAG) recommended that schools and local authorities should ensure that pupils are provided with quality learning experiences where they can develop the skills of practical investigation and problem solving. The report recognised that this can only be done when there is sufficient equipment for hands-on learner practical work. Moreover, it recommended that schools must be provided with adequate funds to provide and maintain sufficient equipment for effective hands-on experiences. In responding to the SEEAG Report, the Scottish Government stated that learners need to continue to have the opportunity to study a range of inspiring, up-to-date science within the Curriculum for Excellence, with opportunities to experience practical science.
- 3 Recognising that more than 10 years have passed since data were gathered about the funding of science practical equipment in Scottish schools³, the LSG determined that it should investigate the current resource allocated for delivering science education in Scottish schools. A further impetus to gather up-to-date information in Scotland was the work undertaken by the Science Community Representing Education (SCORE) on the resourcing of practical science at primary and secondary school levels in England⁴. The research highlighted an acute shortage in schools and sixth form colleges of essential equipment and consumables for practical work in science. There were concerns the situation may be similar in Scotland.
- 4 The LSG Commissioned Pye Tait Consulting to carry out a survey of state (predominantly local authority) maintained primary and secondary schools in Scotland, to gather evidence indicating the state of funding and practical equipment resourcing relating to the delivery of the science curriculum. A sample of schools was identified by the LSG and partners to be invited to participate. An online survey was designed and hosted by Pye Tait Consulting between 6 March and 26 June 2014. The surveys generated responses from 39 individual primary schools and 46 individual secondary schools. Given the small samples, the findings should be read as providing an indication only of the Scotland-wide picture.
- 5 In this document the LSG has distilled the main findings from the surveys. The full Pye Tait survey analysis is also publicly available⁵. The findings provide the LSG with a starting point to engage with local and national government, their agencies and partners, head teachers, parents and industry to raise awareness about science resourcing issues in schools with a view to working towards the provision of better overall arrangements.

Primary School Survey Key Findings

Funding for Science

- 6 Among surveyed primary schools in Scotland, the average annual spend on science per capita was £1.62 in 2013–14. This compares with an average per capita spend on science of £2.89 in 2011–12 in primary schools in England, as reported by SCORE.
- 7 However, there is significant variation in spending on science among those Scottish primary schools surveyed. A number indicated that per capita science spend in 2013–14 was nil, with the highest recorded per capita spend that year being £17.14.
- 8 44% of those primary schools surveyed indicated that they were either very or quite dissatisfied with the funding available for science practical work.

Science Equipment and Consumables

- 9 58% of primary schools believe they do not have sufficient equipment and consumables to deliver science practical work effectively. Furthermore, 52% feel they do not have sufficient access to training on the use of science equipment and consumables.

2 Supporting Scotland's STEM Education and Culture; SEEAG; February 2012 <http://www.scotland.gov.uk/Publications/2012/02/4589/0>

3 The Funding of Scottish Physics Departments; Scottish Science Issues; 32, 6–11, 2001; ASE

4 Resourcing of Practical Science in Secondary Schools; SCORE; May 2013 <http://score-education.org/media/11805/score%20resourcing%20secondary.pdf>
Resourcing of Practical Science in Primary Schools; SCORE; May 2013 <http://score-education.org/media/11808/score%20resourcing%20primary.pdf>

5 www.royalsoced.org.uk/1076_LearnedSocietiesGrouponScottishScienceEducation.html

- 10** 59% of primary schools confirmed that they are not free to choose which supplier of science equipment and consumables offer the best value for money. Three schools described issues associated with supply and procurement, notably that having to use an approved list of suppliers can be restrictive, that desirable items are not always available this way, and that the procurement process can take a long time.
- 11** Schools were asked to indicate their ability to access a range of specific equipment and consumables for practical science delivery, including microscopes, balance scales, mirrors, funnels, stopwatches, buzzers and motors. For each listed item of equipment, less than half of primary schools report having enough and all in working order. The main problem appears to be that schools have insufficient supplies of the equipment that they currently use, particularly torches, magnets and magnifiers.
- “After having been on the SSERC residential course science is part of our cluster and school improvement plans, and in order for this to be taken forward successfully, we need adequate resources.”*

Classroom Facilities, Health and Safety and Outdoor Space

- 12** 45% of primary schools report having no access to safety equipment (tongs, sand trays, heat mats and goggles). Furthermore, 53% of respondents indicated that they do not know if their school has the 4th edition of the ASE publication, ‘Be Safe!’ This provides guidance on health and safety matters for those teaching science in primary schools. The Scottish Government has welcomed this publication and commended it to primary teachers.
- 13** 45% of schools report having no access to a well organised and regularly replenished resources area. The majority of primary schools report having easy access to most outdoor resources that can be used for practical science delivery. The two main exceptions are: Access to a pond or other natural water habitat (28% reported having no access but need); and Access to a variety of rock types and soil types (26% reported having no access but need).

Barriers to Resourcing Practical Science

- 14** Budgetary limitations were the most commonly reported barrier to the resourcing of practical science. With primary schools having to focus on many other curriculum areas, school spend on science is not always a priority.
- “Budgets have been cut recently and we are unable to keep up new resources that bring science to life.”*

- 15** Competence and confidence among teachers is reported to be an issue in some primary schools, with staff not always knowing how to use resources to teach effectively.
- “Unless all staff are confident to teach science, equipment will not be requested or used.”*

Secondary School Survey Key Findings

Teaching of Science

- 16** 44% of secondary school respondents are dissatisfied with the level of technician support for delivering effective science practical work. A small number of schools raised concerns that limited or no technician support places great pressure on teachers and takes up valuable time for lesson preparation.
- “The erosion of services such as the staffing ratio of technicians to pupils seriously threatens the delivery of practical science as teachers cannot teach and prepare experiments at the same time.”*
- 17** In addition, 46% of secondary schools reported being dissatisfied with the time available to carry out effective preparation within laboratories for science practical work.

Funding for Science

- 18** Among surveyed secondary schools in Scotland, the average annual spend on science per capita was £7.33 in 2013–14, with the lowest recorded per capita spend that year being £2.00 and the highest at £25.60. This compares with an average per capita spend on science of £10.12 in 2011–12 in state maintained secondary schools in England, as reported by SCORE.
- 19** The largest area of science budget spend among secondary schools is reprographics at 38%, followed by consumables at 27%, with only 17% of the science budget spent on equipment.
- “Essentials such as stationery and reprographics take up a huge part of the budget, then it’s annual consumables and replacing basics due to wear & tear. We never have funds within the budget to buy new innovative equipment or to fund trips.”*
- 20** All but one secondary school reported using at least one additional source of funding to support science practical work. 62% of additional funding for normal curricular science practical work was reported as coming from staff contributing from their own pockets.

21 The majority (80%) of secondary schools are not satisfied that they have sufficient funding available for science practical work. Furthermore, 70% of schools are of the view that any changes to the science budget over the next two years will result in less science practical teaching and hands-on experiences for pupils.

Science Equipment, Consumables and Laboratory Facilities

22 57% of secondary schools believe they have insufficient equipment and consumables to deliver science practical work effectively. Looking forward over the next two years, 82% of schools indicated that they are not confident of having enough equipment and consumables to deliver science practical work effectively.

“Students invariably have to work in large groups or have to share equipment with other classes, or do not do particular practical sessions due to the lack of suitable equipment.”

23 Schools were asked to indicate the level and condition of specific equipment and consumables that can be used for practical science delivery, in relation to their needs. Respondents identified a shortage of basic measurement apparatus, including equipment to measure changes in the body, balances, vernier callipers, energy meters, micrometers and light gates and timers. Schools also reported a lack of equipment, such as genetic engineering kits and smart materials, for teaching new topics.

“The majority of physics equipment is over 40 years old. It is damaged, broken or not working and far too expensive to replace.”

24 Secondary schools were asked to list items of equipment and consumables that science departments would like access to but do not currently possess. The most commonly mentioned were IT and data logging equipment that will allow the amount of data logging required by the latest

qualifications, including the CfE Highers. Only 22% of respondents indicated having enough working data loggers and associated computer equipment.

“It becomes very frustrating for pupils when the procedures they wish to follow are so limited by the level of sophistication of our equipment. We are particularly lacking in IT equipment to support our teaching of science.”

25 In relation to laboratory facilities, 50% of respondents indicated that they do not have easy access to a working fume cupboard which has access to gas, electricity and water.

26 85% of secondary schools confirmed that they are not free to choose which supplier of science equipment and consumables offer the best value for money.

Barriers to Resourcing Practical Science

27 Almost all surveyed secondary schools raised the issue of funding as a critical barrier to investing in new and innovative equipment, repairing or replacing old and outdated equipment, and covering the cost of associated staff training to ensure its effective use.

“Budgets have been frozen and more is spent on paper based course materials over practical science.”

28 Budgetary constraints are a particular issue where curriculum changes place greater and more complex demands on students that cannot be easily met, particularly with respect to data logging equipment.

29 A small number of schools pointed out that the costs involved in carrying out science experiments are not fully understood by school management, local authorities and central government, leaving the impression that, regionally and nationally, science is not as high a priority as it is made out to be.

For further information about the work of the Learned Societies’ Group on Scottish Science Education, contact William Hardie, Secretariat (email: whardie@royalsoced.org.uk)

